

Claims

1. A method for making a two-phase solution of which the phase state changes through temperature conversion react through multiple processes, which is a method for making a number (N) of samples react under the same reaction conditions, wherein the samples have a solution where the phase state of a reaction solvent changes in a reversible manner between a two-phase solution state and a uniform solution state when the temperature fluctuates over or under a certain constant temperature, and the processes are carried out sequentially in the following steps: (A) the constant container heating step of heating a number of reaction containers simultaneously and maintaining the reaction containers at a predetermined temperature; (B) the sample heating step of putting a sample in each heated reaction container and of maintaining a two-phase solution at a predetermined temperature; (C) the reaction step of stirring the sample that has been heated to the predetermined temperature so as to gain a uniform solution, which is maintained for a predetermined period of time; (D) the cooling step of cooling the uniform solution without cooling the reaction container after the predetermined period of time has passed so as to gain a two-phase solution within the reaction container, and the method is characterized in that a sequential operation is carried out in such a manner that the period of time ( $t_B$ ) from the start of putting a sample to the start of stirring and the period of time ( $t_C$ ) from the start of stirring to the start of cooling become the same for all of the samples.
2. The method for making a two-phase solution of which the phase state changes through temperature conversion react through multiple processes, according to Claim 1, characterized in that, in the two-phase solution stage of said reaction solvent, one phase is made of a cycloalkane compound and the other phase is made of one or more types selected from among nitroalkane, nitrile, alcohol, alkyl halide, ether, urea, amide compounds and sulfoxide.
3. The method for making a two-phase solution of which the phase state changes through temperature conversion react through multiple processes, according to Claim 1 or 2, characterized in that the method for cooling the uniform solution without cooling the reaction container in said step

(D) is a method for drawing the uniform solution within the reaction container into a syringe with a cooling apparatus and cooling the uniform solution within the syringe, a method for putting a solid of which the temperature is lower than that of the reaction container into the uniform solution within the reaction container or a method for mixing a compound having a low boiling point directly into the uniform solution within the reaction container.

4. The method for making a two-phase solution of which the phase state changes through temperature conversion react through multiple processes, according to any of Claims 1 to 3, characterized in that said step (B) is carried out on first to Nth samples after said step (A), then said step (C) is carried out on first to Nth samples, and finally said step (D) is carried out on first to Nth samples.

5. An apparatus for making a two-phase solution of which the phase state changes through temperature conversion react through multiple processes, characterized by comprising: a heating means for heating a number of reaction containers simultaneously and maintaining the reaction containers at a predetermined temperature; a sampling means for putting a sample into each reaction container; a stirring means for stirring the sample within the reaction container; a cooling means for cooling the uniform solution within the reaction container without cooling the reaction container so as to gain a two-phase solution within the reaction container; a control means for controlling the time of the start of the operation and the time of the end of the operation for the respective operations: a sampling operation that is carried out by the sampling means, a stirring operation that is carried out by the stirring means and a cooling operation that is carried out by the cooling means.

6. The apparatus for making a two-phase solution of which the phase state changes through temperature conversion react through multiple processes, according to Claim 5, characterized in that, in said two-phase solution, one phase is made of a cycloalkane compound and the other phase is made of one or more types selected from among nitroalkane, nitrile, alcohol, alkyl halide, ether, urea, amide compounds and sulfoxide.

7. The apparatus for making a two-phase solution of which the phase state changes through temperature conversion react through multiple processes, according to Claim 5 or 6, characterized in that said cooling means is

a syringe having a cooling apparatus, a means for putting a solid of which the temperature is lower than that of the reaction container into the uniform solution within the reaction container or a mixing means for mixing a compound having a low boiling point directly into the uniform solution within the reaction container.

8. A method for making a two phase solution of which the phase state changes through temperature conversion react, characterized by comprising the reaction step of stirring a material solution of which the reaction solvent is a solution of which the phase state changes in a reversible manner between a two phase solution state and a uniform solution state when the temperature fluctuates over or below a certain constant temperature within a reaction container at a predetermined temperature so that a uniform solution is gained and reacts; and the cooling step of cooling the uniform solution without cooling the reaction container so that a two-phase solution is gained within the reaction container.

9. The method for making a two phase solution of which the phase state changes through temperature conversion react according to Claim 8, characterized in that, in said cooling step, a portion or the entirety of the uniform solution is extracted from a reaction container, the extracted uniform solution is cooled by a cooler and the two-phase solution that has been gained through cooling is put back into the reaction container.

10. The method for making a two phase solution of which the phase state changes through temperature conversion react according to Claim 8, characterized in that said cooling step is the step of putting a solid of which the temperature is lower than that of the reaction container into the uniform solution within the reaction container so that the uniform solution is cooled.

11. The method for making a two phase solution of which the phase state changes through temperature conversion react according to Claim 8, characterized in that said cooling step is the step of mixing a compound having a low boiling point directly into the uniform solution within the reaction container so that the uniform solution is cooled.

12. The method for making a two phase solution of which the phase state changes through temperature conversion react according to any of Claims

8 to 11, characterized by further comprising the product solution gaining step of extracting the product solution phase from the two-phase solution that has been gained within the reaction container after said cooling step.

13. The method for making a two phase solution of which the phase state changes through temperature conversion react according to Claim 12, characterized in that the solvent phase that remains after the extraction of said product solution phase is reused in the next reaction.

14. The method for making a two phase solution of which the phase state changes through temperature conversion react according to any of Claims 8 to 13, characterized in that, in the two-phase solution stage of said reaction solvent, one phase is made of a cycloalkane compound and the other phase is made of one or more types selected from among nitroalkane, nitrile, alcohol, alkyl halide, carbonate, imidazolidinone, carbodiimide, ester, carboxylic acid, aldehyde, ketone, ether, urea, amide compounds and sulfoxide.

15. An apparatus for making a two phase solution of which the phase state changes through temperature conversion react, characterized by comprising: a reaction container having a heating means for heating the reaction container attached; a stimulating means for physically stimulating a material solution within the reaction container so as to gain a uniform solution; and a cooling means for cooling the uniform solution within the reaction container without cooling the reaction container.

16. The apparatus for making a two phase solution of which the phase state changes through temperature conversion react according to claim 15, characterized in that said cooling means is a means for extracting the uniform solution from a reaction container, cooling the extracted uniform solution with a cooler and returning the two phase solution that has been gained through cooling into the reaction container, a means for putting a solid of which the temperature is lower than that of the reaction container into the uniform solution within the reaction container, or a mixing means for mixing a compound having a low boiling point directly into the uniform solution within the reaction container.